# Production of Oocytes from Human ES Cells

## Grant Award Details

Production of Oocytes from Human ES Cells

**Grant Type:** SEED Grant

**Grant Number:** RS1-00416

**Investigator:**

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| **Name:** | Grant MacGregor |
| **Institution:** | University of California, Irvine |
| **Type:** | PI |

**Human Stem Cell Use:** Embryonic Stem Cell

**Award Value:** $385,466

**Status:** Closed

## Progress Reports

**Reporting Period:** Year 2

**View Report**

**Reporting Period:** NCE

**View Report**

## Grant Application Details

**Application Title:** Production of Oocytes from Human ES Cells

**Public Abstract:** The ability of human embryonic stem (hES) cells to form a wide variety of adult human cell types offers hope for development of novel therapies to treat human degenerative diseases such as Alzheimer's, diabetes, and muscular dystrophy. However, to prevent rejection of the transplanted cells by a patient's immune system it will be important to use hES cell derived tissues that are immunologically matched to the patient. One way to do this involves somatic cell nuclear transplantation (SCNT) where the nucleus containing the genetic information is transferred from a patient's cell into a human oocyte (egg) from which the nucleus has been removed. The oocyte is then stimulated to divide into a small group of cells from which new hES cells are derived. As cells derived from these hES cells contain the patient's DNA they will be immune-matched to the patient, thereby preventing tissue-rejection.While SCNT has been performed using cells and eggs from mice, it is not yet possible to do this on a routine basis using human cells and eggs. One reason for lack of progress concerns the scarce supply of human oocytes available for research. Oocytes are usually obtained from women undergoing hormonal treatment for infertility, when permission is given for unused and unwanted oocytes to be used for research. However, a severe shortage and great demand for such material has stimulated efforts to recruit suitable donors from the general public, often with financial incentive. There is significant health and ethical concern about such policies and the potential negative impacts of such procedures on long-term health of women are unclear.Remarkably, recent research with mice suggests that it may be possible to produce oocytes from hES cells. If so, the oocytes produced may be of use for SCNT to produce new lines of personalized-hES cells for treatment of patients. If successful, this would be expected to have at least two major benefits to the public. First, women would no longer be required as a source of eggs for research, which would reduce the risk of such treatments on women's long-term health. Second, this would generate a theoretically infinite increase in the quantity of oocytes available for research, which would in increase the rate at which technical advances could be made in production of immune-matched hES via SCNT.Consequently, the proposed research will investigate methods for production of germ cells and oocytes from female hES cells. Specifically, we will test our prediction that it is possible to coax hES cells in culture to form germ cells and ultimately mature oocytes by exposing hES cells to different cell proteins and hormones that are normally used by the body to generate eggs. If successful, these protocols will help accelerate research on development of therapeutic cloning for a wide range of diseases. This would also obviate ethical concerns regarding egg-donation by women and would help protect women's health.

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| **Statement of Benefit to California:** | The proposed research involves investigating how human embryonic stem (hES) cells form germ cells and oocytes, in a cell culture dish in the laboratory. The long-term goal of the research is to develop methods that enable production of such eggs in vitro. If successful, the research will benefit Californians in areas of healthcare and economy. Regarding healthcare, the ability to produce significant quantities of human oocytes in the laboratory will accelerate development of methods for reliable development of new hES cell lines from human oocytes following transfer of nuclei from a patient's cell (i.e. therapeutic cloning). The ability to generate hES cells that are immunologically matched to a patient would also preclude the need for use of immunosuppressive drugs during treatment of patients with hES cell-derived material. Such drugs can have unwanted side effects on patients and could also have as yet unrecognized negative effects on ability of hES cell-derived tissues to engraft into a patient's organs. Immunosuppressive therapy also increases the overall expense of treatment, due to the treatment itself as well as treating any side effects from its use.<br><br>Success of the proposed research would significantly reduce any requirement for donation of unused human oocytes. This would benefit California women by protecting them from undergoing unwanted and unnecessary hormonal stimulation for which the long-term health effects are currently unclear. If successful, the research could also have significant economic benefit to the State of California. First, successful development of this technology could be transferred to biomedical industry, and the potential worldwide market for such methods is considerable. This could stimulate employment in a variety of sectors as well as increasing state tax revenue. Equally important, a successful research outcome could also reduce the overall cost of healthcare to the State. It is anticipated that low-income individuals are more likely to be willing to donate eggs for research. While this may provide them with short term financial benefit, it is possible that such individuals could develop significant age-related health problems involving hormonal imbalance, such as infertility, polycystic ovarian syndrome, bone-loss, cognitive decline and obesity. In this event, the burden of providing healthcare to such individuals would likely fall to the State. Thus, reducing the incidence of egg-donation by in-state residents is likely to minimize any costs associated with treatment of such donors in the future. |

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